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ORIGINAL ARTICLE

Evaluation of Demographic Characteristics and Therapeutic Response to ocular Chemical Burn in Patients Referred to Eye Emergency Department of Farshchian Hospital in 2015-2016

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ABSTRACT

Purpose: Chemical injuries are true ocular emergencies and require immediate evaluation and treatment. The complication of severe chemical burn is permanent. The aim of this study is evaluation of demographic information and therapeutic response of ocular chemical burn.
Methods: In this cross-sectional study 250 patients with ocular chemical burn who referred to Farshchian Hospital were enrolled. Demographic characteristic and information regarding the burn were obtained. The Hughes-Roper-Hall classification was used for grading the severity of injury. All patients were reevaluated 6 weeks later after injury. **Results:** Of 250 patients with complete follow-up, 155 cases (62%) were male, and 95 cases (38%) were female. Chemical injury were more common in the 20-40 years age group (108 case =43/2%).The most common cause of chemical injury were occupational injury (120 case = 48%). 127 case (50/8%) of patients referred during the first hour after injury. The most common material of injury was acid in 102 cases (40/8%).Grade I burn was seen in 92 cases (36/8%) and grade IV in 30 cases (12%).Grading of the injury was related to the referring time after chemical burn. Severity of injury was more in alkaline burn. In 50% of grade IV causes the burn had alkaline origin; however only 13/3% of acid burn had grade IV severity. (p: 0/001) **Conclusion:** The incidence of ocular chemical burn was approximately 2/19% of all patients who referred to emergency ophthalmology service. According to this study, ocular injury are more common in the men 20-40 years age group. The most common cause was occupational injury. Delay in referring and alkaline material was poor prognostic factors.

INTRODUCTION

The chemical eye burn is one of the major emergencies in the ophthalmology that will result in irreparable complications in case of inappropriate and timely treatment in severe cases (1-4). The chemical eye burn, in particular due to occupational injuries, is of the most important health problems of societies around the world. These injuries continue to be a health problem at work, despite decades of discussion about eye protection at work (1, 5 and 6).

The disease is known to be preventable in all cases. The chemical eye burn is often seen in the age group of 20-40 years (1 and 7-11). Young men are more at risk (1, 7).

Chemical injuries may occur with alkali, acid or other active organic ingredients such as pepper spray, tear gas and Ethyl Cyanoacrylate adhesive. Due to the widespread use of strong acids and bases for industrial use and health, chemical burns are common causes of eye damages (12). The severity of burns depends on the type of chemical and the onset of treatment. Particularly, alkaline substances cause serious damages when the duration of contact with the substance is longer. Alkaline substances are combined with cell membrane fluid (saponification); following this reaction, the epithelium breaks down and the alkali can penetrate rapidly into the cornea and even into the anterior chamber. Scleral collagen tissue is also damaged and wrinkled; thrombosis, occlusion and ischemia occur after vascular burns.

Given that, limited studies have been conducted in our country (Iran) about the causes of chemical eye burn. This study explored the demographic characteristics and therapeutic response to the chemical burn in the patients referred to the eye emergency department of the Farshchian Hospital in 2015-2016.

MATERIALS AND METHODS

The present cross-sectional study was carried out on the patients with chemical eye burns who referred to the eye emer-

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gency department of Farshchian hospital in 2015-2016. An ophthalmologist for each of these cases completed a questionnaire consisting of information in line with the research objectives. The demographic characteristics and background information on the burns were collected, and complete ocular examination was performed.

The patients were asked about the type of substance (acid/alkali/I do not know) to determine the type of chemical. All patients were admitted to the emergency room under extensive eyewash with normal saline serum to normalize pH for treatment. After treatment The Hughes-Roper-Hall classification was used to assess the severity of chemical damages. Accordingly, the chemical burns were divided into four degrees. The ocular examination was performed again six weeks later to detect the response rate to the treatment.

RESULTS

In the present study, 312 patients referred to the Emergency Department of Farshchian Hospital in 2015-2016 who complained of eye burning and met inclusion criteria with satisfaction were enrolled in the study. Of these, 62 cases were excluded from the study due to lack of referral for reexamination. Finally, 250 people entered the study to analyze the data. The significance level in this study was considered to be 0.05. The participants included 155 (62%) males and 95 (38%) females. The most frequent age group was 20 to 40 years old constituting 108 (43.2%) subjects and the next rank was related to the age group of 40 to 60 years. Most of the substance caused eye burns in patients were acidic substances, so that almost 40% of the participants in the study were suffering from acid injuries.(Table 1)

There was a significant relationship between harmful substance and response to treatment. Thus, 69 patients (50.7%) who had a good response to treatment had acid injuries, while the good response to treatment was 21.3% (n=29) in the alkaline group. In contrast, bad response rate to treatment was 26.5% in the acidic group and 38.8% in the alkaline group. The results of the treatment in less than an hour showed that 60.3% had a good response, while results of the treatment more than an hour indicated 39.7% good response.(Table 2)

Table 1. Demographic characteristics of patients with ocular chemical burn

Variable	Number	Percent
Sex		
Male	155	62
Female	95	38
Age group (years)		
1-20	48	19.2
21-40	108	43.2
41-60	67	26.8
>60	27	10.8
Chemical agent		
Acids	102	40.8
Alkalis	79	31.6
Unknown	69	27.6
Place of incident		
Work place	120	48
Home	104	41.6
Others	26	10.4
Latency on referral to the emergency		
Less than one hour	127	50.8
More than one hour	123	49.2
Grade of injury		
I	92	36.8
II	77	30.8
III	51	20.4
IV	30	12

DISCUSSION

The aim of this study was to investigate the demographic characteristics and response to treatment of chemical eye burn in the patients referred to emergency department of Farshchian hospital.

Although chemical eye damages account for a small proportion of eye damages, but they can cause serious damages and impose huge expenses for the patients and the health system (7-10). The chemical eye burn, in particular due to occupational injuries, is of the most important health problems of societies around the world. These injuries continue to be a health problem at work, despite decades of discussion about eye protection at work (12-15).

In the present study, the participants included 155 (62%) males and 95 (38%) females. This suggests that men are more at risk for chemical eye burn injuries due to their working conditions and jobs; this vulnerable group needs further attentions to reduce the occupational injuries (1 and 7).

Our study results revealed that the age group of 20 to 40 years was more at increased risk constituting 108 (43.2%) subjects and the next rank was related to the age group of 40 to 60 years. The results of previous studies also show that the maximum outbreak of eye damages occurs between 20 and 40 years, in line with our findings (1, 7 and 11).

The cause of higher incidence of these damages in people between the ages of 20 and 40 years may be due to the high frequency of people in this age group who are working in workshops and factories. On the other hand, low experience and non-compliance with work safety issues can be considered as other factors involved in the high prevalence of chemical injuries in this age group, especially in men.

The results of this study showed that acidic substances were the most causative agent of eye burn in the patients so that almost 40% of the participants in the study suffered from acid injuries, consistent with the results of previous studies (16-18). In a study by Mohammad Reza Jafari Nasab et al, 45.2% of patients reported acidic substances the reason for the chemi- cal eye burn, 14.6% knew the alkali materials causing injury and 40.2% did not know the type of substances leading to injuries (1).

Table 2. Grade of injury and response to treatment according to latency on referral to the emergency in ocular chemical burn

Latency on referral to the emergency	Grade of injury number(%)				Response to treatment number(%)		
	I	II	III	IV	Good	Intermediate	Weak
Less than one hour	53 (57.6)	49 (63.6)	20 (39.2)	5 (16.7)	82 (60.3)	35 (53.8)	10 (20.4)
More than one hour	39 (42.4)	28 (36.4)	31 (60.8)	25 (83.3)	54 (39.7)	30 (46.1)	39 (79.6)
P value	0.0001				0.001		

In the present study, the most common place where people suffered injury was the workplace as 120 (48%) people experienced the event at workplace, which indicates occupational injuries are still the most important cause of eye damages. Our results were consistent with the findings of Maghsoudi H et al., which revealed that occupational injuries are still the main cause of chemical eye burns (18). Kuckelkorn et al. reported that 171 patients with diagnosis of eye burn had been referred to the emergency department during one year, of which 61% of cases were caused by occupational injuries, 37% were due to domestic factors and 2% had unclear causes (11-12).

The present results showed that the highest eye damages (36.8%) observed in the slit-lamp examination in the participants had grade I, and the least damages (12%) observed with a downtrend were related to grade IV. This can be the fact that the most common harmful agents in the patient was acidic substances; another reason might be immediately referral of the patients to treatment center after the injury who received proper care given the medical education of this study.

Approximately half of the subjects participated in the study had interval less than an hour from the time of injury until admission. This could reflect the fact that most of the patients had fairly acceptable information about the hazards and side effects of chemical eye burns, and that the chemical burns, even in mild cases, cause significant symptoms in the patient that forces them to visit health centers.

According to the results of this study, there was a significant relationship between harmful substance and response to treatment. Thus, 69 patients (50.7%) who had a good response to treatment had acid injuries, while the good response to treatment was 21.3% (n = 29) in the alkaline group. In contrast, the bad response rate to treatment was 26.5% in the acidic group and 38.8% in the alkaline group.

As expected, the results of our study showed that the grade of eye damage was higher in individuals with eye burns caused by alkaline materials, so that 50% of cases with grade IV referred due to alkaline burns, while the eye damages observed with the slit-lamp examination showed 13.3% of grade IV in the injured patients with acidic substances, which was statistically significant. Previous studies have also indicated that alkaline substances cause more severe damages to acidic substances (19-23). The alkali compounds due to the hydrophilic and lipophilic properties can pass through the cell membrane, enter into anterior chamber and cause severe eye damages. Acid burns usually cause fewer damages than alkaline burns because large amounts of cor- neal proteins are combined with acid compounds that act as a chemical buffer. In addition, coagulated tissues act as a barrier and prevent excessive acid penetration. The highest damages caused by alkaline substances occur at pH>11 (18).

The results of our study demonstrated that 60.3% of the patients who referred to the emergency department within less than an hour after the onset of events showed a good response to treatment, while 39.7% of those who had a delay of more than one hour in admission responded appropriately to treatment. This suggests that rapid treatment, especially washing with normal saline or water in these patients, prevents further damages and accelerates treatment. Our results are consistent with a study of Palao et al who suggested that accelerating the treatment of patients with chemical eye burn via abundant water causes fewer damages in these patients (24).

According to the findings of the present study, the most common group affected by eye burns is men aged 20 to 40 years at workplace. Additionally, people who had a delay of more than an hour after chemical burns with alkaline substances did not show good response to treatment.

It is suggested that more studies should be carried out with larger sample sizes in whole country for more accurate evaluation of chemical eye burn incidence.

Due to the exclusion of approximately 20% of the study subjects in the follow-up period, the study results may have been bias. Because the characteristics of people excluded from the study may be different from the people remained in the study, this can be a sign of selection bias. The results of this study might have inadequate for generalization, due to the evaluation of only one center.

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